7th Annual Science & Engineering Technology Symposium

Spring 2006

Session IV: Transitioning Disruptive Technologies

Naval Approach to Disruptive Technologies and Transition

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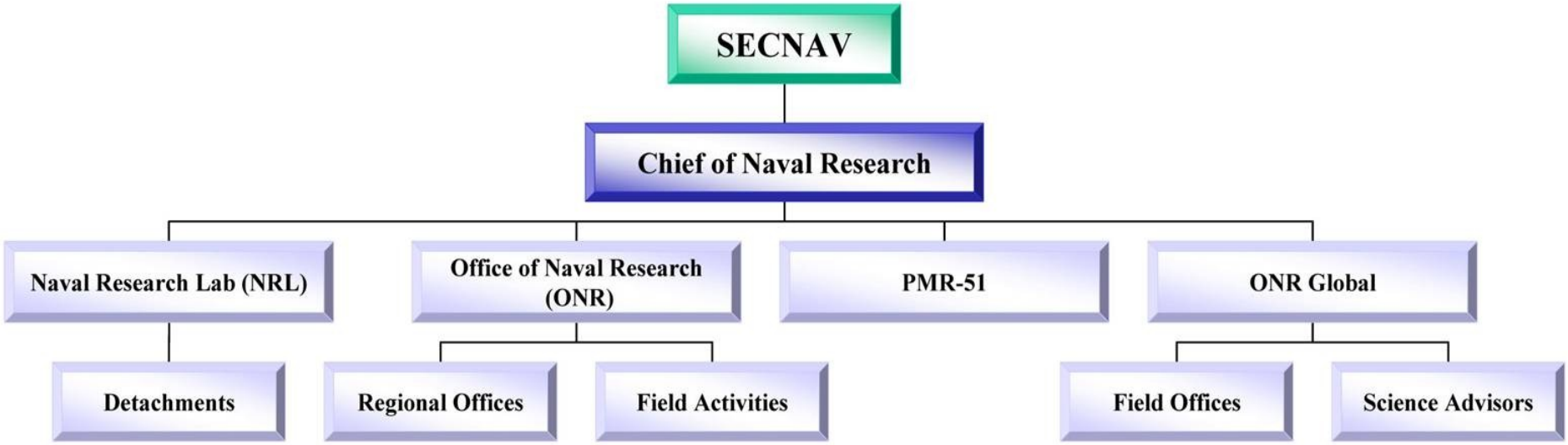
ONR 351

Overview

- Organization and Responsibilities
- Relationship of Transformational Projects and Disruptive Technologies
- Current Programs
- Future Plans
- Summary

ONR Organization

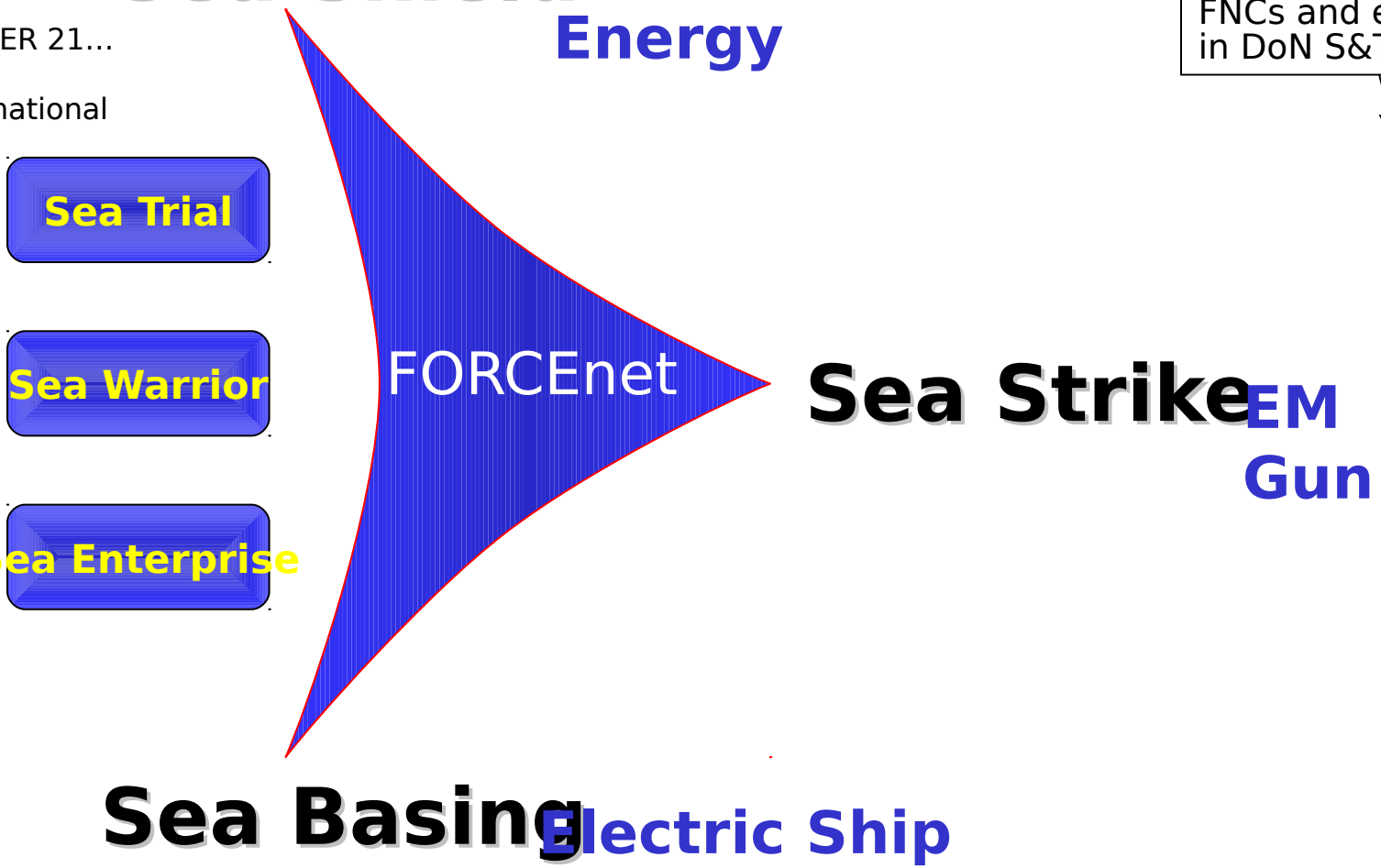


S&T for Naval Transformation

Relevant Research and Results . . .Yesterday, Today, and Tomorrow

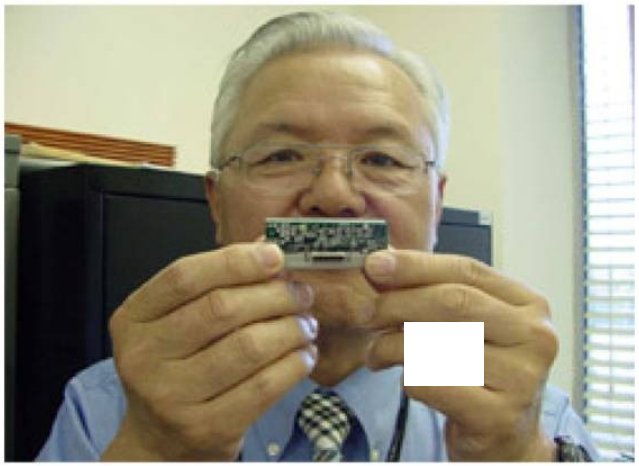
Selected transformational projects funded in FNCs and elsewhere in DoN S&T

SEA POWER 21…
Naval Transformational Roadmap

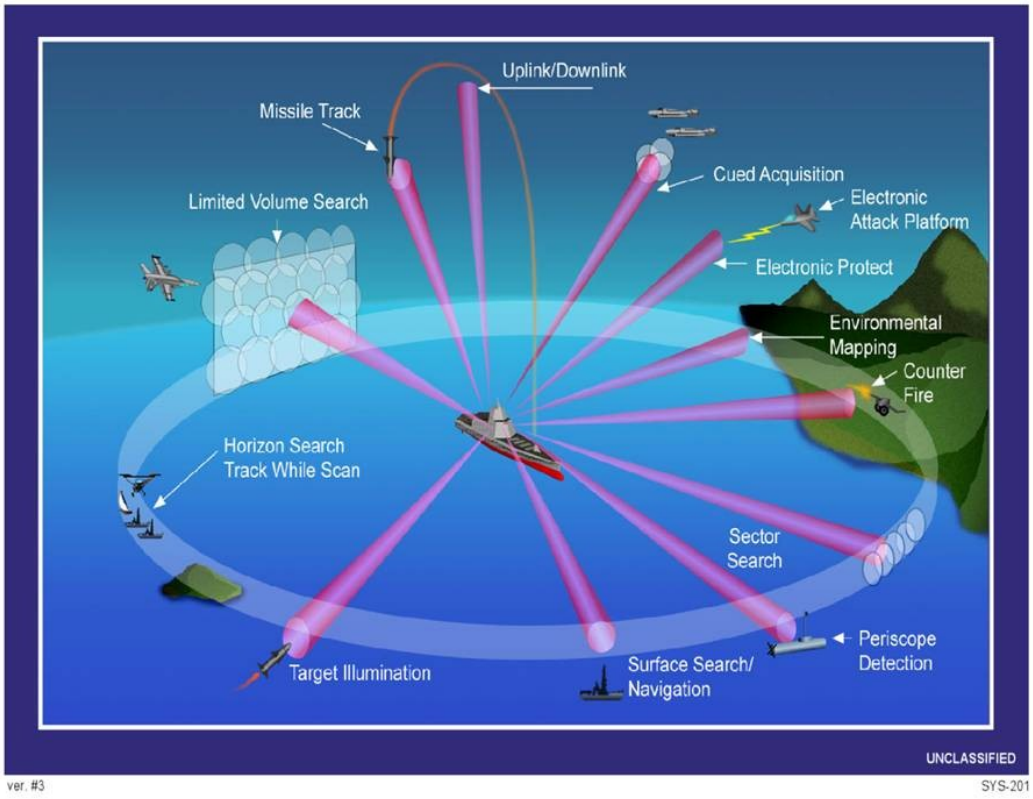


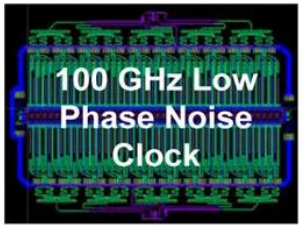
Information, Electronics and Surveillance (Code 31)

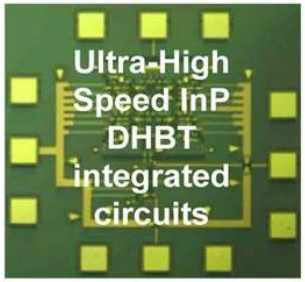
- Surveillance capabilities, communications, command and control
- New concepts for electronic devices
- Application of information sciences to complex problems including human-computer interaction
- Electronic warfare

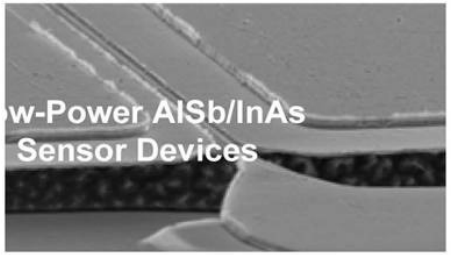


Advanced Multi-Function RF





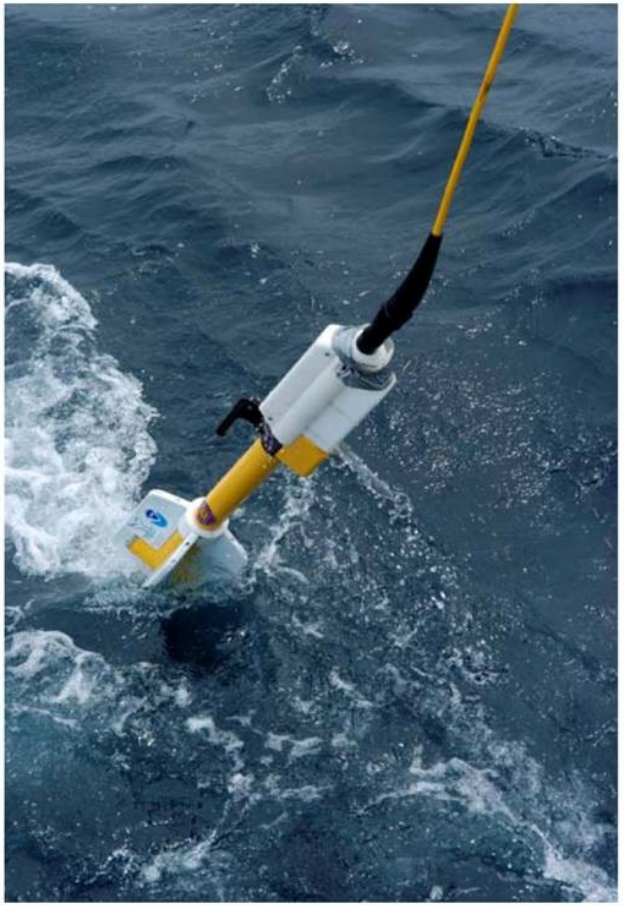




technologies to meet future radar requirements

Ocean, Atmosphere, and Space (Code 32)

- Battlespace Environments - (BSE)
- Anti-Submarine Warfare - (ASW)
- Mine Warfare - (MIW)
- Naval Special Warfare/Explosive Ordnance Disposal
- Advanced Force Operations



Autonomous Vehnicles

Letting robots do the dangerous work

Engineering, Materials, and Physical Sciences (Code 33)

- Chemistry
- Physics
- Structural & functional materials
- Structural, solid, & fluid mechanics
- Propulsion
- Energetics
- And hull, mechanical,
- & electrical systems

Virtual At Sea Training (VAST)

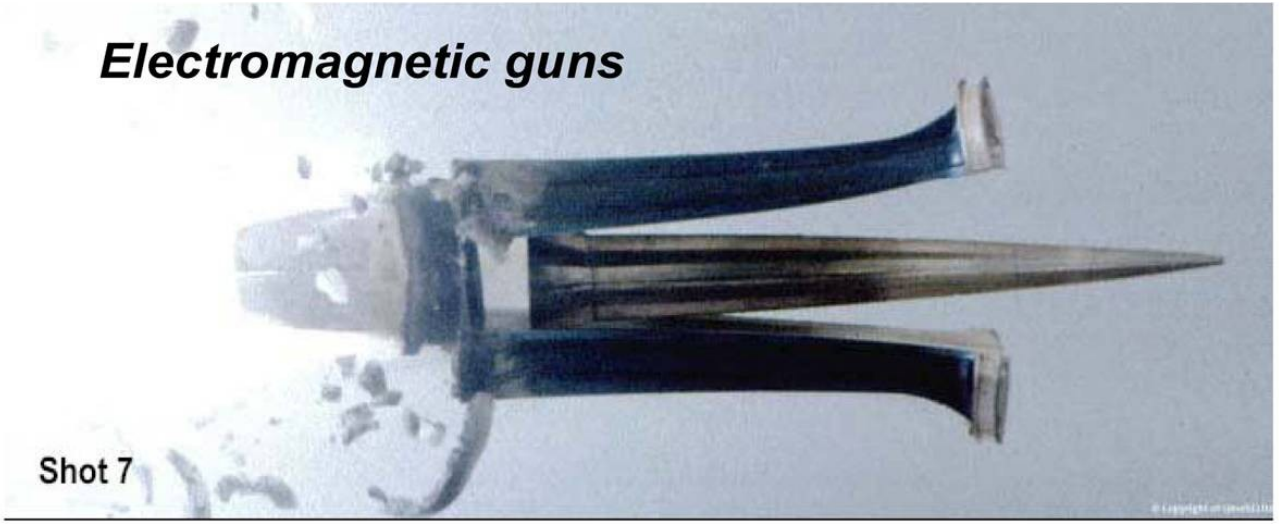
Realistic fire support training for the Navy-Marine Corps Team

Naval Expeditionary Warfare (Code 35)

- Aeronautics, avionics
- Propulsion, ballistics, warheads
- Missile guidance, seekers
- Parallel distributed processing
- Technology programs particularly associated with Marine Corps/ground combat applications

Hypersonic Strike

Speed kills



Human Systems (Code 34)

- Exploration programs at the leading edge of medical science
- Human performance
- Biotechnology
- Training and human factors
- Neural information processing
- Biorobotics

Navy Perspective for Disruptive Technologies

The Electric Warship enables Electric and Directed Energy weapons warfighting capabilities well beyond that currently available to US Navy.

Attainment of these capabilities continue to be a focal thrust for Disruptive Technology investments for the Navy.

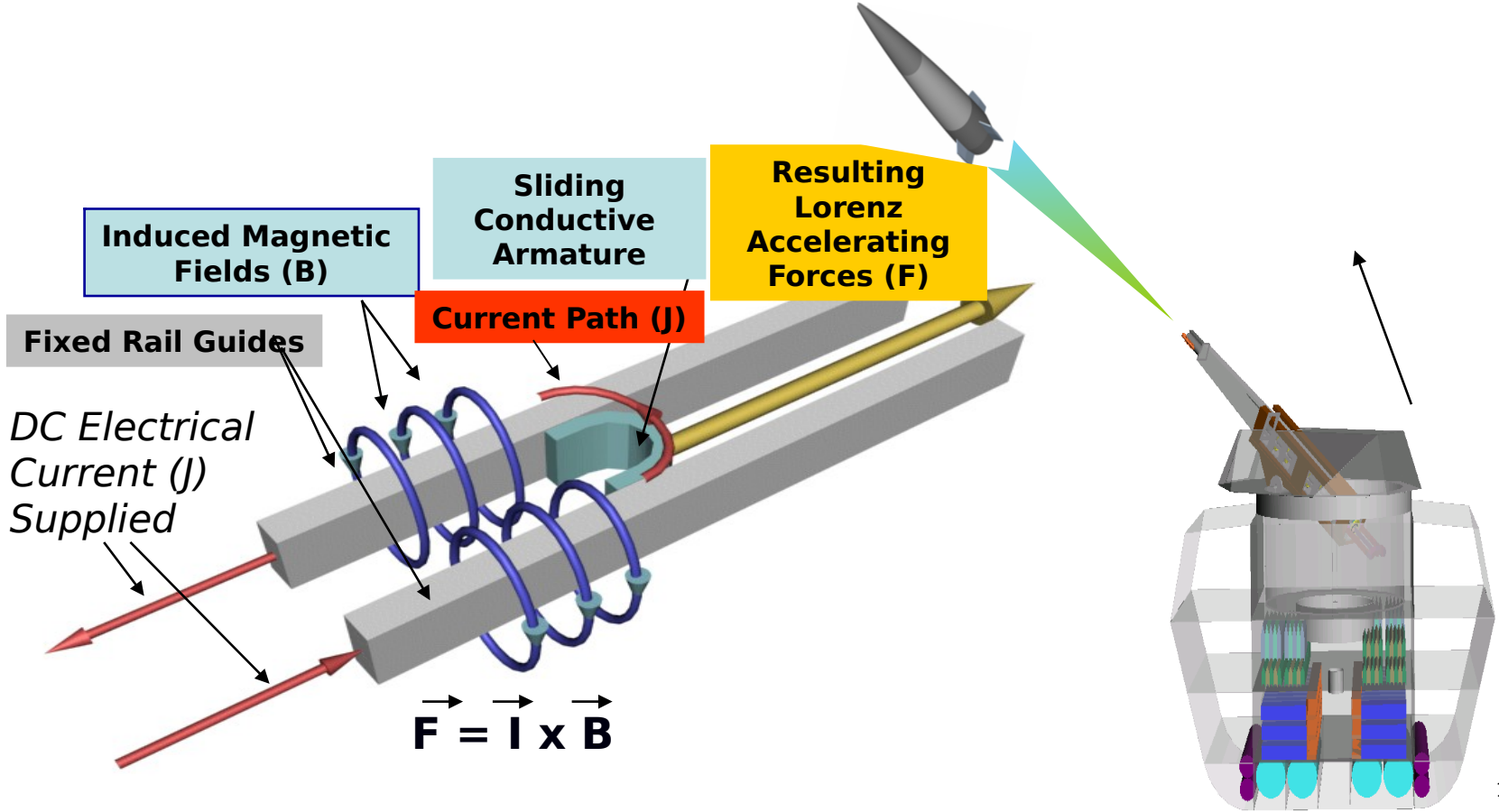
Some Disruptive Technologies are:

- Electric Weapons (Rail Gun)
- Directed Energy Applications
  - Free Electron Laser
  - Other Lasers
  - High Power Microwave

Electromagnetic Launcher

Long Range Gun Demonstration Prototype – FY12
Navy S&T Most Critical Issues:

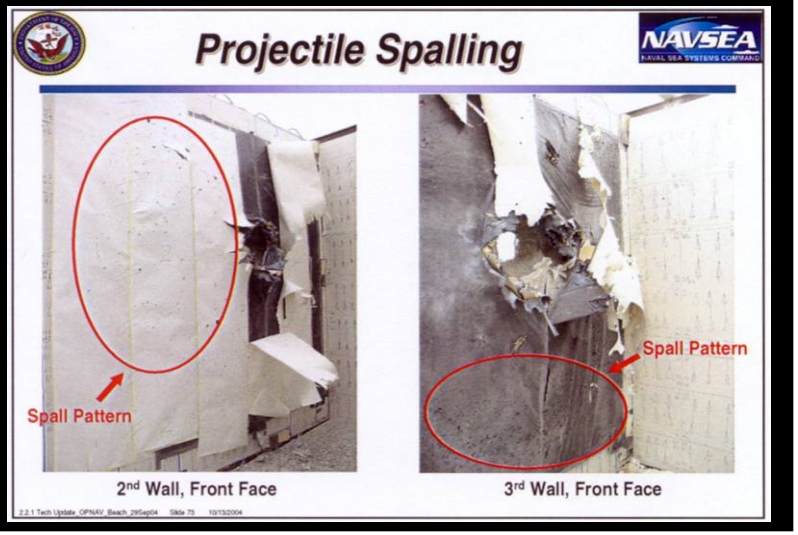
- Physics of Materials/Dynamics at High Energy State
- Factors for Electromagnetic Performance & Efficiency


Induced Magnetic Fields (B)
Sliding Conductive Armature
Resulting Lorenz Accelerating Forces (F)
Current Path (J)
Fixed Rail Guides
DC Electrical Current (J) Supplied
F = I x B

Rail Gun!!

Target Setup
NAVSEA
Three Re-enforced, Construction Grade Concrete Walls
Positioned 1.1 km downrange
Railgun Projectile was 1/10 scale mass

Projectile Impact
NAVSEA
3rd Wall, Back Face
2nd Shot
1st Shot
Side View,
Three Wall Target
(2nd Shot)


Projectile Spalling
NAVSEA
Spall Pattern
Spall Pattern
2nd Wall, Front Face
3rd Wall, Front Face

NAVAL STRIKE FIGHTER HIGH ENERGY LASER (HEL)

Warfighting Payoff:

- Benefit to all programs considering HEL weapon by providing accurate analytic tools
- Address shortcomings in current HEL Engineering & Warfare Models and Simulations to sufficient level to support Acquisition Process
- Leverage currently accepted models and simulations by upgrading HEL modules, develop new simulation if no acceptable baseline exists
- Coordinate simulation

Working Transitions:

- F/A-18 E/F
- DEW JUCAV
- JSF

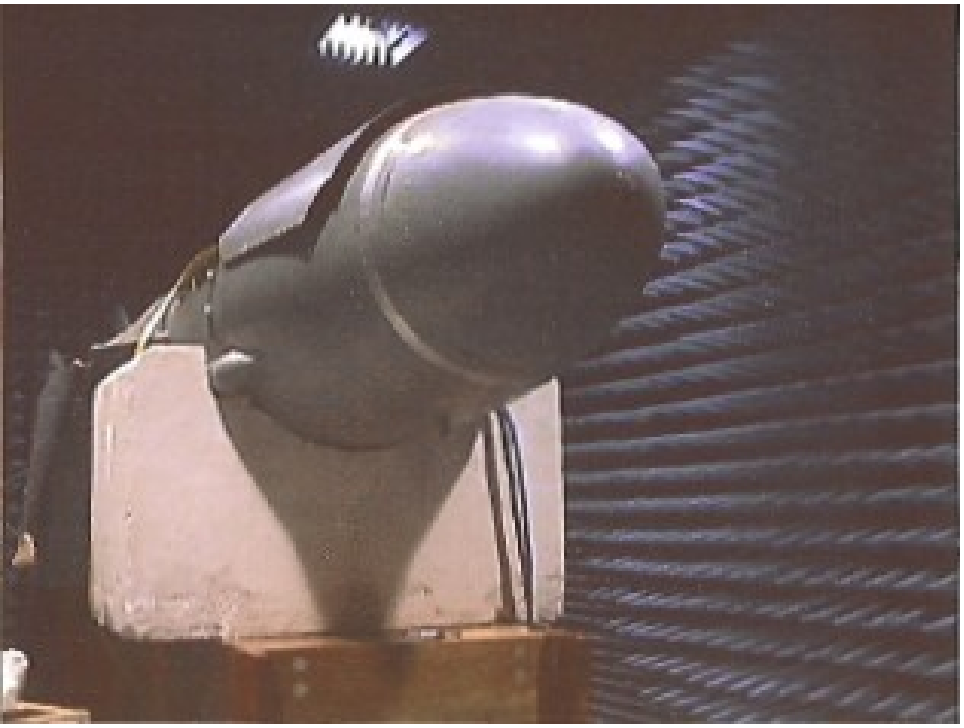
High Power Microwave

- Specific Areas of Interest
  - Anti-missile Defense
  - Counter Munitions
  - Command and Control Warfare
  - Suppression of Enemy Air Defense (SEAD)
  - Ballistic Missile Defense
  - Air Craft Self Protect
- Approach
  - Apply High Power Microwave Technology to damage or upset electronics of systems so as to produce a mission kill

Research Underway

Susceptibility of Missiles

- RF induced deception (more desirable)
- RF Damage

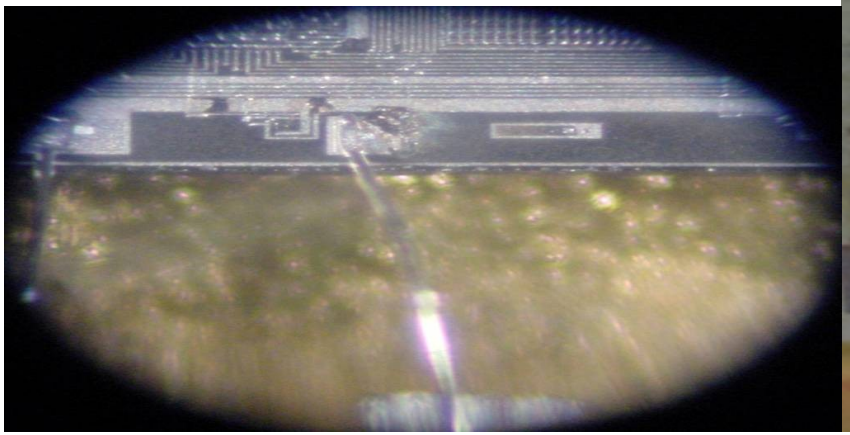


Examined COTS systems to identify susceptibilities

- Carried out RF effects

RF Effects On Electronic Circuits

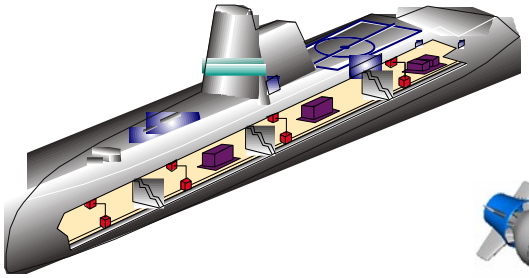
- Focused beams used to probe electronic susceptibilities of electronic modules and components to identify particularly vulnerable pathways
- Modeling and simulation is employed to verify effects and causes of susceptibilities
  - PSPICE
  - Finite Element Codes
  - Finite Difference Time Domain



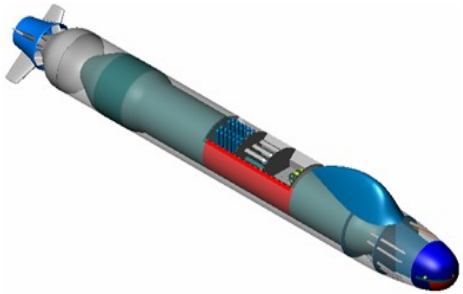
Engine Stopping

- Examining techniques for causing engines to stop running
  - Focusing on marine outboard engines
  - Part of a tri-service effort on engines
- System and Componer
- Level Testing

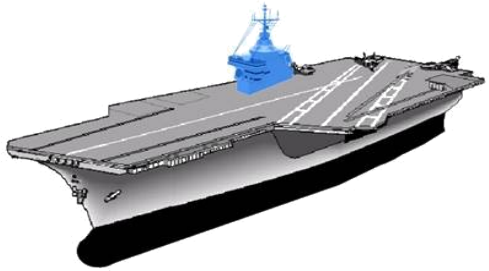
The Future Is Electric



- Podded Propulsion
- Fuel Cells
- High Pulsed Power Sensors
- High Energy / Speed of Light Weapons



- Electric Propulsion
- Replace Diesel and Battery
- Control Surfaces
- Weapons Launch



- Aircraft Launch and Recovery
- Speed of Light Defensive Weapons
- Advanced Survivability Systems
- Advanced Storage and Distribution

- Hybrid Propulsion
- Enhanced Stealth
- Pulsed Power Weapons and Sensors

How Can Industry and Academia Help?

- The **Office of Naval Research** coordinates, executes, and promotes the science and technology programs of the United States Navy and Marine Corps through schools, universities, government laboratories, and nonprofit and for-profit organizations. It provides technical advice to the Chief of Naval Operations and the Secretary of the Navy and works with industry to improve technology manufacturing processes.

- ONR maintains a close relationship with the research and development community to support long-range research, fosters future discovery of technologies, and nurtures next generations of researchers for the future Navy and Marine Corps.